R-matrix Analysis for Improvement of the International Standard Cross Section

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This report will introduce:

1. Our R-matrix Analysis Code RAC, which has a full implementation of the error propagation law and several approaches for processing uncertainty of data, has the identical calculation precision with EDA (LANL) and SAMMY (ORNL), has the ability to analyze all kinds of observable existing in one (or two) compound nucleus system (same as EDA), and has many special functions designed for producing standard cross section of light nucleus.

2. The error propagation features of R-matrix model fitting for several light nucleus systems has been studied systematically with RAC. The propagation of covariance depends on the intrinsic features of R-matrix parameters and the error distribution of data. The standard error propagation coefficient P can be expressed by a very simple experience formula. The medium energy range component of systematic error plays very important function for error propagation.

3. The analysis of ^{7}Li system and ^{11}B system with RAC separately. The result of 7Li system has been used in the test combining with the result of GMA to produce the standard cross section 6Li (n, t). The standard errors and covariance of combining fit have got much improvement than the quoted values in ENDF/B6. There are some principal difference between the results of RAC and EDA, and the causes for bring out the difference are being studied.

4. The analysis of ^{7}Li system and ^{11}B system with RAC simultaneously. It is done by using the data base of ^{7}Li system, the data base of ^{11}B system, and the relative data about ^{6}Li(n,t)/^{10}B(n,α_0) and ^{6}Li(n,t)/^{10}B(n,α_1). This new evaluation procedure can produce more precise and consistent result for standard cross section.

5. Several approaches for processing uncertainty of data are studied systematically. e. g., full implementation of the error propagation law; splitting the full uncertainty at statistical uncertainty and normalization uncertainty. For a given simulation data sets of ^{7}Li system, the primary result show that the calculated covariance matrixes of ^{6}Li(n,t) are different. The causes for bring out the differences are explained in detail.

6. How about the positive definiteness of the result obtained by using RAC. The method to improve the positive definiteness is studied.

7. The possibility for the occurrence of PPP in R-matrix analysis. We have searched the causes for the occurrence of PPP in GMA, and found the some main causes do not exist in our R-matrix analysis; the systematical calculations show that there is not this possibility for the occurrence of PPP in our R-matrix analysis.

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